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INFORMATION RECEIVING/DISPLAY APPARATUS AND INFORMATION RECEIVING/DISPLAY METHOD

RELATED APPLICATION DATA

The present application claims priority to Japanese Application No. P2000-101271 filed Mar. 31, 2000, which application is incorporated herein by reference to the extent permitted by law.

BACKGROUND OF THE INVENTION

This invention relates to an information receiving/display apparatus and an information receiving/display method, especially those based on a novel operation principle.

Modern information transmission started with remote transmission of audio information together with appearance of radio receivers as information receiving equipment. That is, radio receivers are means for transmitting audio information (sound) to people at remote locations and invoke their auditory sense to give them information. Subsequent to radios, television sets were invented as information receiving equipment. Television systems are means for transmit visual information (images) and auditory information (sounds) as electric waves to people at remote locations and invoke their visual sense and auditory sense to give them information.

Humans have five senses, namely, visual sense, auditory sense, olfactory sense, gustatory sense and tactile sense. However, modern information transmission has dealt with visual information and auditory information only, and transmission of the remainder olfactory information, gustatory information and tactile information has not yet been realized.

Even if it is tried to implement current television sets with the function of receiving and displaying at least one of olfactory information, gustatory information and tactile information, gustatory sense and tactile sense are proximately discernible senses humans can perceive something when directly touching it (distance 0), and incompatible with TV. Therefore, such implementation is impossible. Also regarding olfactory information, since chemical properties cannot be decomposed and recomposed, unlike three primary colors (RGB) of visual information, it is basically difficult to implement TV sets with the function of receiving and displaying olfactory information. Moreover, since olfactory receptors are considered to amount as many as the order of $N=10^6$, basic chemical cells as many as N or $N^{1/2}$ have to be prepared for reproduction of olfactory information, and this is extremely difficult in the present situation. Also from this point of view, reception and display of olfactory information are difficult.

Difficulty in implementing TV sets with the function of receiving and displaying sensory information lies in not having a display with a flexible plane. That is, when people touch screens of CRT displays, which are currently the most widely distributed displays, they merely discern cold and hard texture of glass. Although there is a recent development of a system enabling a user to trace the screen with a finger, the user can perceive only a rough stereognostic contour therefrom, and there are not techniques that provide remote reproduction of delicate tactile texture of surfaces. Additionally, it is basically impossible to touch images displayed on CRT display screens from their backs. Although liquid crystal displays (LCD) and plasma display panels (PDP) have recently come to be introduced in lieu of

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CRT displays, the above-reviewed conditions have not been changed yet with them.

As reviewed above, although humans fortunately have five senses, namely, three remotely discernible senses (visible sense, auditory sense, olfactory sense) and two proximately discernible senses (tactile sense, gustatory sense), what can be actually transmitted has been limited to audio-visual information. Although there is a trial to synthesize voices from movements of faces, this is not but mere introduction of auditory information from visual information, and does not break through the category of audio-visual techniques.

In the era of progressively high-leveled networks, those information communication techniques, which are rather lopsided, involve the possibility of rendering humans quasi-malnourished and inviting hazards from the standpoints of maintaining or developing salutary sensory functions, and further from the standpoint of brain evolution.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an information receiving/display apparatus and an information receiving/display method that enable reception and display of third sensory information, such as tactile information or olfactory information, in addition to visual information and/or auditory information.

Another object of the invention is to provide a an information receiving/display apparatus and an information receiving/display method that are simple in structure, easy to increase the scale of the information display area, unlikely to produce distortion along edges of the information display area during reproduction of a large solid angle image when the information display area is large-scaled, quickly responsive, capable of changing the shape of the information display plane to various shaped including a concave shape, if necessary, extendible, light, thin and flexible.

According to the first aspect of the invention, there is provided an information receiving/display apparatus configured to receive information for at least one of remotely discernible senses and information for at least one of proximately discernible senses, and display them on an information display plane.

According to the second aspect of the invention, there is provided an information receiving/display method characterized in receiving information for at least one of remotely discernible senses and information for at least one of proximately discernible senses, and displaying them on an information display plane.

In the first and second aspects of the invention, the remotely discernible sense is visual sense, auditory sense or olfactory sense, and the proximately discernible sense is tactual sense or gustatory sense. For example, at least two of information for remotely discernible senses and said information for proximately discernible senses are given as functions of positions on the information display plane. Additionally, information of sound, surface roughness, relative surface temperature or relative surface humidity, for example, is represented on the information display plane in addition to image information. Typically, the information display plane is made of an optical fiber or an optical waveguide having a liquid core, and a fiber having a liquid cores, and image information is displayed by scattering light introduced into said core from one end or opposite ends of said optical fiber or waveguide by means of light scattering elements in said core at a selected portion in response to an